

SEQUENCE LISTING

<110> Flint, Dennis

Meyer, Knut

Viitanen, Paul

<120> Sinapoylglucose:Malate Sinapoyltransferase Form Malate
Conjugates From Benzoic Acid Glucosides

<130> BC1034 US NA

<140> US 60/216,615

<141> 2000-07-07

<150> 60/216,615

<151> July 7, 2000

<160> 19

<170> Microsoft Office 97

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| Val | Asp | Ser | Ala | Ser | Ile | Val | Lys | Phe | Leu | Pro | Gly | Phe | Glu | Gly | Pro |
| | | | 20 | | | | | 25 | | | | | 30 | | |
| Leu | Pro | Phe | Glu | Leu | Glu | Thr | Gly | Tyr | Ile | Gly | Ile | Gly | Glu | Asp | Glu |
| | | 35 | | | | | 40 | | | | | 45 | | | |
| Asn | Val | Gln | Phe | Phe | Tyr | Tyr | Phe | Ile | Lys | Ser | Glu | Asn | Asn | Pro | Lys |
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| Leu | Gly | Gly | Ile | Ile 85 | Phe | Glu | Asn | Gly | Pro 90 | Val | Gly | Leu | Lys | Phe | Glu 95 |
| Val | Phe | Asn | Gly 100 | Ser | Ala | Pro | Ser | Leu 105 | Phe | Ser | Thr | Thr | Tyr 110 | Ser | Trp |
| Thr | Lys | Met 115 | Ala | Asn | Ile | Ile | Phe 120 | Leu | Asp | Gln | Pro | Val 125 | Gly | Ser | Gly |
| Phe | Ser 130 | Tyr | Ser | Lys | Thr | Pro 135 | Ile | Asp | Lys | Thr | Gly 140 | Asp | Ile | Ser | Glu |
| Val 145 | Lys | Arg | Thr | His 150 | Glu | Phe | Leu | Gln | Lys | Trp 155 | Leu | Ser | Arg | His | Pro 160 |
| Gln | Tyr | Phe | Ser | Asn 165 | Pro | Leu | Tyr | Val | Val 170 | Gly | Asp | Ser | Tyr | Ser | Gly 175 |
| Met | Ile | Val 180 | Pro | Ala | Leu | Val | Gln 185 | Glu | Ile | Ser | Gln | Gly | Asn 190 | Tyr | Ile |
| Cys | Cys | Glu 195 | Pro | Pro | Ile | Asn | Leu 200 | Gln | Gly | Tyr | Met | Leu 205 | Gly | Asn | Pro |
| Val 210 | Thr | Tyr | Met | Asp | Phe | Glu 215 | Gln | Asn | Phe | Arg | Ile 220 | Pro | Tyr | Ala | Tyr |
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| Cys | Asn | Gly | Asn 245 | Tyr | Tyr | Asn | Val | Asp 250 | Pro | Ser | Asn | Thr | Gln | Cys 255 | Leu |
| Lys | Leu | Thr | Glu 260 | Glu | Tyr | His | Lys | Cys 265 | Thr | Ala | Lys | Ile | Asn 270 | Ile | His |
| His | Ile 275 | Leu | Thr | Pro | Asp | Cys | Asp 280 | Val | Thr | Asn | Val 285 | Thr | Ser | Pro | Asp |
| Cys | Tyr 290 | Tyr | Tyr | Pro | Tyr | His 295 | Leu | Ile | Glu | Cys | Trp 300 | Ala | Asn | Asp | Glu |
| Ser 305 | Val | Arg | Glu | Ala | Leu 310 | His | Ile | Glu | Lys | Gly 315 | Ser | Lys | Gly | Lys | Trp 320 |
| Ala | Arg | Cys | Asn | Arg 325 | Thr | Ile | Pro | Tyr | Asn 330 | His | Asp | Ile | Val | Ser 335 | Ser |
| Ile | Pro | Tyr | His 340 | Met | Asn | Asn | Ser | Ile 345 | Ser | Gly | Tyr | Arg | Ser 350 | Leu | Ile |
| Tyr | Ser | Gly 355 | Asp | His | Asp | Ile | Ala 360 | Val | Pro | Phe | Leu | Ala 365 | Thr | Gln | Ala |
| Trp 370 | Ile | Arg | Ser | Leu | Asn | Tyr 375 | Ser | Pro | Ile | His | Asn 380 | Trp | Arg | Pro | Trp |
| Met 385 | Ile | Asn | Asn | Gln | Ile 390 | Ala | Gly | Tyr | Thr | Arg 395 | Ala | Tyr | Ser | Asn | Lys 400 |

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| tacattggta ttggtgagga cgagaatgtg caatttttct actatttcat caaatctgaa | 180 |
| aacaatccaa aagaagatcc tcttcttata tggttaaatg gaggacctgg atgttcttgt | 240 |
| cttggtggtg ttatTTTTga gaacggaccg gtgggtttga agtttgaggt gttcaacgga | 300 |
| agtgtcctt ctttgttctc tactacatat tcatggacaa agatggcaaa catttatattc | 360 |
| ttggatcagc cagtaggac tggcttctcc tactcaaaaa ctccaattga taaaactggg | 420 |
| gacataagtg aagtaaagag gacccatgag tttcttcaaa agtggctaag caggcatcca | 480 |
| caatatttct ccaacccttt atatgtagtt ggagattctt attccggtat gattgtcccg | 540 |
| gccctcgttc aagaaatctc acaaggaaat tatatatgtt gcgaacctcc tataaatcta | 600 |
| cagggttata tgcttgga aa cctgtaaca tatatggact ttgaacaaaa cttccgcatt | 660 |
| ccatatgctt atgggatggg attaatctcc gacgaaatct atgagccaat gaagagaatc | 720 |
| tgcaacggaa attattacaa tgtggatcca tctaacacac aatgtttgaa acttactgaa | 780 |
| gaatatcata agtgcactgc caaaataaat atccatcaca tattaacacc agattgcat | 840 |
| gtaaccaatg taacatctcc tgattgttat tattatccat atcatctcat tgaatgttgg | 900 |
| gctaacgacg agagcgctcg cgaagctctt catattgaaa agggtagtaa aggaaaatgg | 960 |
| gcgcgatgta atcggactat tccatacaat cacgacattg taagcagcat accatatcac | 1020 |
| atgaataaca gcatcagtgg ataccgatct cttatttaca gtggtgatca cgacatcgcg | 1080 |
| gtcccttttc ttgcaactca agcctggata agatctctca attactcccc cattcataac | 1140 |
| tggaggccat ggatgataaa caatcaaate gctggataca cgagagctta ttccaataag | 1200 |
| atgacatttg ctactatcaa aggaggtgga cacacggcag agtatagacc aaacgagacc | 1260 |

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| aaaccgggta cattggtatt ggtgaggacg agaatgtgca atttttctac tatttcatca | 120 |
| aatctgaaaa caatccaaaa gaagatcctc ttcttatatg gttaaattga ggacctggat | 180 |
| gttcttgtct tgggtggtatt atttttgaga acggaccggt gggtttgaag tttgaggtgt | 240 |
| tcaacggaag tgctccttct ttgttctcta ctacatatc atggacaaag atggcaaaca | 300 |
| ttatatctct ggatcagcca gtaggatctg gcttctccta ctcaaaaact ccaattgata | 360 |
| aaactggtga cataagtga gtaaagagga cccatgagtt tcttcaaaag tggctaagca | 420 |
| ggcatccaca atatttctcc aaccctttat atgtagttgg agattcttat tccggtatga | 480 |
| ttgtcccggc cctcgttcaa gaaatctcac aaggaaatta tatatgttgc gaacctccta | 540 |
| taaatctaca gggttatatg cttggaaacc ctgtaacata tatggacttt gaacaaaact | 600 |
| tccgcattcc atatgcttat ggtatgggat taatctccga cgaaatctat gagccaatga | 660 |
| agagaatctg caacggaaat tattacaatg tggatccatc taacacacaa tgtttgaaac | 720 |
| ttactgaaga atatcataag tgcactgcc aaataaatat ccatcacata ttaacaccag | 780 |
| attgcatgt aaccaatgta acatctctctg attgttatta ttatccatat catctcattg | 840 |
| aatgttgggc taacgacgag agcgttcgag aagctcttca tattgaaaag ggtagtaaag | 900 |
| gaaaatgggc gcgatgtaat cggactattc catacaatca cgacattgta agcagcatac | 960 |
| catatcacat gaataacagc atcagtggat accgatctct tattttacagt ggtgatcacg | 1020 |
| acatcgcggt cccttttctt gcaactcaag cctggataag atctctcaat tactccccca | 1080 |
| ttcataactg gaggccatgg atgataaaca atcaaatcgc tggatacacg agagcttatt | 1140 |
| ccaataagat gacatttgct actatcaaag gaggtggaca cacggcagag tatagaccaa | 1200 |
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| Phe | Glu | Leu | Glu | Thr | Gly | Tyr | Ile | Gly | Ile | Gly | Glu | Asp | Glu | Asn | Val | |
| | | | 20 | | | | | 25 | | | | | 30 | | | |
| Gln | Phe | Phe | Tyr | Tyr | Phe | Ile | Lys | Ser | Glu | Asn | Asn | Pro | Lys | Glu | Asp | |
| | | 35 | | | | | 40 | | | | | 45 | | | | |
| Pro | Leu | Leu | Ile | Trp | Leu | Asn | Gly | Gly | Pro | Gly | Cys | Ser | Cys | Leu | Gly | |
| | 50 | | | | | 55 | | | | | 60 | | | | | |
| Gly | Ile | Ile | Phe | Glu | Asn | Gly | Pro | Val | Gly | Leu | Lys | Phe | Glu | Val | Phe | |
| 65 | | | | | 70 | | | | 75 | | | | | | 80 | |
| Asn | Gly | Ser | Ala | Pro | Ser | Leu | Phe | Ser | Thr | Thr | Tyr | Ser | Trp | Thr | Lys | |
| | | | | 85 | | | | | 90 | | | | | 95 | | |
| Met | Ala | Asn | Ile | Ile | Phe | Leu | Asp | Gln | Pro | Val | Gly | Ser | Gly | Phe | Ser | |
| | | | 100 | | | | | 105 | | | | | 110 | | | |
| Tyr | Ser | Lys | Thr | Pro | Ile | Asp | Lys | Thr | Gly | Asp | Ile | Ser | Glu | Val | Lys | |
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| Arg | Thr | His | Glu | Phe | Leu | Gln | Lys | Trp | Leu | Ser | Arg | His | Pro | Gln | Tyr | |
| | 130 | | | | | 135 | | | | | 140 | | | | | |
| Phe | Ser | Asn | Pro | Leu | Tyr | Val | Val | Gly | Asp | Ser | Tyr | Ser | Gly | Met | Ile | |
| 145 | | | | | 150 | | | | | 155 | | | | | 160 | |
| Val | Pro | Ala | Leu | Val | Gln | Glu | Ile | Ser | Gln | Gly | Asn | Tyr | Ile | Cys | Cys | |
| | | | | 165 | | | | | 170 | | | | | 175 | | |
| Glu | Pro | Pro | Ile | Asn | Leu | Gln | Gly | Tyr | Met | Leu | Gly | Asn | Pro | Val | Thr | |
| | | | 180 | | | | | 185 | | | | | 190 | | | |
| Tyr | Met | Asp | Phe | Glu | Gln | Asn | Phe | Arg | Ile | Pro | Tyr | Ala | Tyr | Gly | Met | |
| | | 195 | | | | | 200 | | | | | 205 | | | | |
| Gly | Leu | Ile | Ser | Asp | Glu | Ile | Tyr | Glu | Pro | Met | Lys | Arg | Ile | Cys | Asn | |
| | 210 | | | | | 215 | | | | | 220 | | | | | |
| Gly | Asn | Tyr | Tyr | Asn | Val | Asp | Pro | Ser | Asn | Thr | Gln | Cys | Leu | Lys | Leu | |
| 225 | | | | | 230 | | | | | 235 | | | | | 240 | |
| Thr | Glu | Glu | Tyr | His | Lys | Cys | Thr | Ala | Lys | Ile | Asn | Ile | His | His | Ile | |
| | | | | 245 | | | | | 250 | | | | | 255 | | |
| Leu | Thr | Pro | Asp | Cys | Asp | Val | Thr | Asn | Val | Thr | Ser | Pro | Asp | Cys | Tyr | |
| | | | 260 | | | | | 265 | | | | | 270 | | | |
| Tyr | Tyr | Pro | Tyr | His | Leu | Ile | Glu | Cys | Trp | Ala | Asn | Asp | Glu | Ser | Val | |
| | | 275 | | | | | 280 | | | | | 285 | | | | |
| Arg | Glu | Ala | Leu | His | Ile | Glu | Lys | Gly | Ser | Lys | Gly | Lys | Trp | Ala | Arg | |
| | 290 | | | | | 295 | | | | | 300 | | | | | |

Cys Asn Arg Thr Ile Pro Tyr Asn His Asp Ile Val Ser Ser Ile Pro
 305 310 315 320
 Tyr His Met Asn Asn Ser Ile Ser Gly Tyr Arg Ser Leu Ile Tyr Ser
 325 330 335
 Gly Asp His Asp Ile Ala Val Pro Phe Leu Ala Thr Gln Ala Trp Ile
 340 345 350
 Arg Ser Leu Asn Tyr Ser Pro Ile His Asn Trp Arg Pro Trp Met Ile
 355 360 365
 Asn Asn Gln Ile Ala Gly Tyr Thr Arg Ala Tyr Ser Asn Lys Met Thr
 370 375 380
 Phe Ala Thr Ile Lys Gly Gly Gly His Thr Ala Glu Tyr Arg Pro Asn
 385 390 395 400
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| | |
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| ttcaacggaa gtgctccttc tttgttctct actacatatt catggacaaa gatggcaaac | 360 |
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| aaaactgggtg acataagtga agtaaagagg acccatgagt ttcttcaaaa gtggctaagc | 480 |
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| attgtcccgg ccctcgttca agaaatctca caaggaaatt atatatgttg cgaacctcct | 600 |
| ataaatctac agggttatat gcttggaac cctgtaacat atatggactt tgaacaaaac | 660 |
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| aagagaatct gcaacggaaa ttattacaat gtggatccat ctaacacaca atgtttgaaa | 780 |
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| gattgcatg taaccaatgt aacatctcct gattgttatt attatccata tcatctcatt | 900 |
| gaatgttggg ctaacgacga gagcgttcgc gaagctcttc atattgaaaa gggtagtaaa | 960 |
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| ccatatcaca tgaataacag catcagtgga taccgatctc ttatttacag tggatgacac | 1080 |
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| attcataact ggaggccatg gatgataaac aatcaaatcg ctggatacac gagagcttat | 1200 |
| tccaataaga tgacatttgc tactatcaaa ggaggtggac acacggcaga gtatagacca | 1260 |
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 50 55 60
 Leu Pro Leu Leu Pro Lys Glu Ser Arg Tyr Trp Leu Arg Glu Ile Leu
 65 70 75 80
 Leu Cys Ala Asp Gly Glu Pro Trp Leu Ala Gly Arg Thr Val Val Pro
 85 90 95
 Val Ser Thr Leu Ser Gly Pro Glu Leu Ala Leu Gln Lys Leu Gly Lys
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 115 120 125
 Phe Ile Glu Ile Gly Arg Asp Ala Gly Leu Trp Gly Arg Arg Ser Arg
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<223> open reading frame of the chloroplast-targeted CPL fusion protein

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          35          40          45
Ala Ser Asn Gly Gly Arg Val Ser Cys Met Gln Val Trp His Met Ser
          50          55          60
His Pro Ala Leu Thr Gln Leu Arg Ala Leu Arg Tyr Cys Lys Glu Ile
65          70          75          80
Pro Ala Leu Asp Pro Gln Leu Leu Asp Trp Leu Leu Leu Glu Asp Ser
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Ile Arg Glu Gly Phe Val Glu Gln Asn Glu Ile Pro Glu Glu Leu Pro
          115          120          125
Leu Leu Pro Lys Glu Ser Arg Tyr Trp Leu Arg Glu Ile Leu Leu Cys
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Ala Asp Gly Glu Pro Trp Leu Ala Gly Arg Thr Val Val Pro Val Ser
145          150          155          160
Thr Leu Ser Gly Pro Glu Leu Ala Leu Gln Lys Leu Gly Lys Thr Pro
          165          170          175
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          180          185          190
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